minusve planam disposita; involucris 6.3–7.5 (8.5) mm altis, cylindricis; phyllariis 13–16, stramineis, apicibus pallide viridibus; floribus 3–4 (5); corollis flavis, 4.6–5.4 mm longis, dentibus, 1.7–2.6 (3.0) mm longis; antheris 2.1–2.3 mm longis, appendicibus 0.5 mm longis; stylus ramis 2.2–3 mm longis, appendice lineis stigmaticis longiore; achaenis 2.5–3 mm longis, sparse pubescentibus, pilis 0.1–0.25 mm longis, raro glabris. Cotyledones 7 mm longae, 3 mm latae, spathulatae.

Type: New Mexico, Otero Co.: shaded loamy soil in Pinyon-Juniper-Oak Association on the "Upper Burro Flats" at 6000 ft between LaLuz and LaBorcita canyons, 7 mi NE by road from town of LaLuz, T15S, R10E, Sec 14 and 15, *Anderson 2052* (KSC, MSC, NMC, UC—holotype, US, UTC). The type collection was propagated at Claremont, California, as transplants taken from the type locality; *Anderson 1905* (KSC) represents immature specimens from the type locality.

Additional specimens examined: New Mexico, Otero Co.: Sacremento Mountains, *Rehder 331* (US); *332* (US); High Rolls, *Vaughn 2155* (ARIZ); NW of High Rolls, *Jackson 8083* (NMC). Socorro Co.: Mt. Oscuro at 6000–7000 ft, *Dunn & Lint 4030* (NMC).

This species, isolated by 150 mi from its near relatives, is distinct by having spatulate cotyledons (found in no other *Chrysothamnus*), spatulate to oblanceolate leaves, long style appendages, achenes with few, very short hairs, and unlike other members of the *C. viscidiflorus* alliance, the broken twigs emit a fragrance similar to that of *C. nauseosus*. The species can be further distinguished from *C. viscidiflorus* (of which ssp. *lanceolatus* probably is the nearest relative) by its height, free style branches with long appendages, and lack of swelling at the point of staminal departure from the broader corolla tube (fig. 2).

Department of Botany, Kansas State University, Manhattan

Literature Cited

Blake, S. F. 1940. New species and new names among Arizona Asteraceae. Jour. Wash. Acad. Sci. 30:467–472.

Hall, H. M. and F. E. Clements. 1923. The phylogenetic method in taxonomy. The North American species of Artemisia, Chrysothamnus, and Atriplex. Carnegie Inst. Publ. 326:1–355.

Keck, D. D. 1958. Taxonomic notes on the California flora. Aliso 4:101–114.

Munz, P. A. 1959. A California flora. Univ. Calif. Press, Berkeley.

DAVID DOUGLAS AND THE DIGGER PINE: SOME QUESTIONS

James R. Griffin

While collecting in the central coast region of California in 1831, David Douglas described *Pinus sabiniana* Dougl. in a letter written at Mission San Juan Bautista (Douglas, 1833). Descriptive passages in this letter—and sketches later made from the specimens—leave no doubt that Douglas had studied *P. sabiniana* cones, seed, and foliage at San Juan

and sent them to England. He made no specific mention of where the material had been gathered, and his geographic notes are of little help in suggesting the locality. The collection may have come from the Gabilan hills southeast of San Juan, as Jepson (1910) speculated, or it might have come from the easily accessible Pine Canyon stand to the southwest (fig. 1).

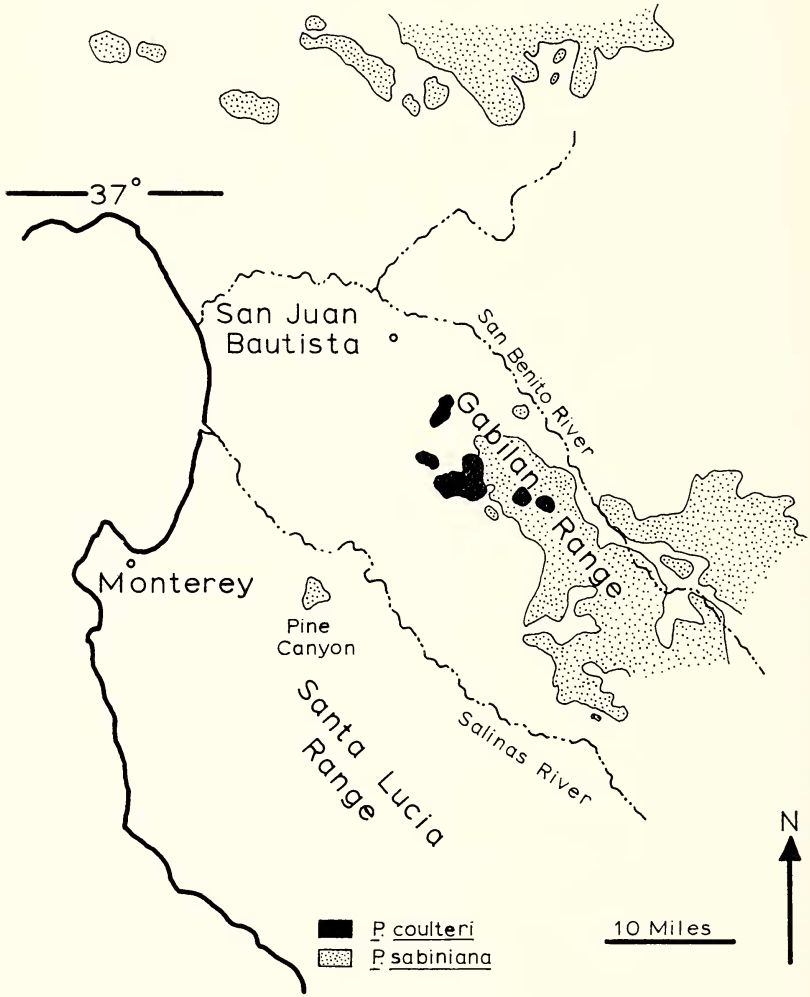

Fig. 1. Present distribution of *Pinus sabiniana* and *P. coulteri* in the San Juan Bautista area of central California. (Adapted from unpublished vegetation type maps of the Pacific Southwest Forest and Range Experiment Station, U. S. Department of Agriculture, Berkeley, California.)

Other parts of the description, however, raise the question of whether Douglas had ever carefully observed *P. sabiniana* trees in the field or not. Did he possibly confuse this species with some other local pine? Paradoxically, he never mentioned the striking character of irregular crown branching so typical of the species. Instead he used such phrases as "The trees are of a tapering form, straight, and of regular growth, 40 to 120 feet in height, 2 to 12 feet in circumference, clothed with branches to the ground, when standing far apart or solitary." The dimensions quoted are reasonable, but "tapering", "straight", and regular growth" are terms with little relevance to this species.

What other pine might have been involved in this ambiguous description? Perhaps it was *Pinus coulteri* D. Don. During this period Douglas climbed the Gabilan range near San Juan to take geodetic observations. He may well have encountered *P. coutleri* on the higher ridges, for it can still be seen there from the vicinity of the mission. Stands of *P. coulteri* are more conspicuous and accessible to one climbing the hills near San Juan than those of *P. sabiniana* (fig. 1). Yet, Douglas made no mention of *P. coulteri* in any of his writings which are still available to us. If he missed *P. coulteri* on the Gabilan range, he should have seen it later when he traveled through the Santa Lucia mountains to the south. In any case, he did send *P. coulteri* specimens and seed to England in 1832. This collection was apparently labeled as a variety of *P. sabiniana* (Little, 1948). When Loudon (1838) eventually looked at this material, he questioned the *P. sabiniana* label. After consulting Don he decided it was the same species that Don had received from Thomas Coulter and named *P. coulteri.*

If the *P. sabiniana* variety label on the *P. coulteri* collection accurately summarized Douglas' views on the two pines, those who are acquainted with these relatively distinct pines are left with an unsatisfying feeling about the affair. Why did a botanist of such competence not describe *P. sabiniana* more clearly or why did he not discuss *P. coulteri* even if only as a variety within *P. sabiniana*? Only a few years before Douglas had repeatedly risked his life to track down a new pine. In this case he appeared to have lumped together two easily available species. Douglas did not seem to be inclined to create broad tree species, and with considerable perception he separated several new fir species differing only in rather subtle characters. I can only emphasize the difficulties here, for no answers are now available. But it would be interesting to know if Douglas combined some of his field observations of *P. coulteri* with some *P. sabiniana* specimens which had been given to him when he composed the San Juan letter. It would also be very interesting if we could go back in time to Monterey in 1832 and hear Douglas discuss these pines with his colleague Thomas Coulter.

Pacific Southwest Forest and Range Experiment Station, Redding, California

Literature Cited

Douglas, D. 1833. Description of a new species of the genus Pinus. Trans. Linn. Soc. 16:747–749.

Jepson, W. L. 1910. The Silva of California. Mem. Univ. Calif. Vol. 2. Univ. Calif. Press, Berkeley.

Little, E. L. 1948. David Douglas' new species of conifers. Phytologia 2:485–490.

Loudon, J. C. 1838. Arboretum et fruticetum Brittannicum. Vol. 4. Longman, London.

BARK PHOTOSYNTHESIS IN OCOTILLO

H. A. Mooney and B. R. Strain

Ocotillo (*Fouquieria splendens* Engelm.) is a unique plant of the Sonoran Desert in respect to its physiology and candelabra growth form. The rapidity of leaf development following an increase in soil moisture after a drought period has been the object of numerous investigations. In only a few days after rain, leaves may fully develop on bare stems (Cannon, 1905). The problem of survival during extensive drought periods has been studied also. As early as 1905, Cannon noted that, "Although seemingly lifeless during the drought the plant is not dormant, since beneath its gray exterior there is a chlorophyllous bearing tissue which enables the photosynthetic process to go on, even if in a feeble manner . . ." Later, Scott (1932) described the anatomy of this bark chlorenchyma and noted its association with water storage cells and leaf primordia.

The objective of this study was to determine if bark chlorophyllous tissue contributes to the photosynthetic economy of this plant. Bark photosynthesis during leafless periods could be of adaptive significance in respect to extended drought tolerance and might also be involved in the rapidity of ephemeral leaf production.

Photosynthesis and respiration measurements were made in the field on portions of stems of two mature plants growing in Deep Canyon near Palm Desert, California.[1] Measurements were made when the plants were in full leaf in March and when leafless subsequent to drought in May. A cylindrical double-walled plexiglass chamber was placed on the stem and sealed at both ends (fig. 1). Air temperature within the chamber was controlled by water flowing through the jacket from a constant temperature bath. The CO_2 content of air passing through the chamber, and of free air, was determined with a Beckman model 15A infrared gas analyzer. Air flow rate was maintained at 120 liters per hour.

When the plants were in leaf, measurements were made in the light and in a darkened chamber. Then, all leaves were removed and addi-

[1] We would like to express our appreciation to Lloyd P. Tevis for information relevant to ocotillo behavior in Deep Canyon as well as the personnel of the Philip L. Boyd Desert Research Center for assistance and the use of facilities.